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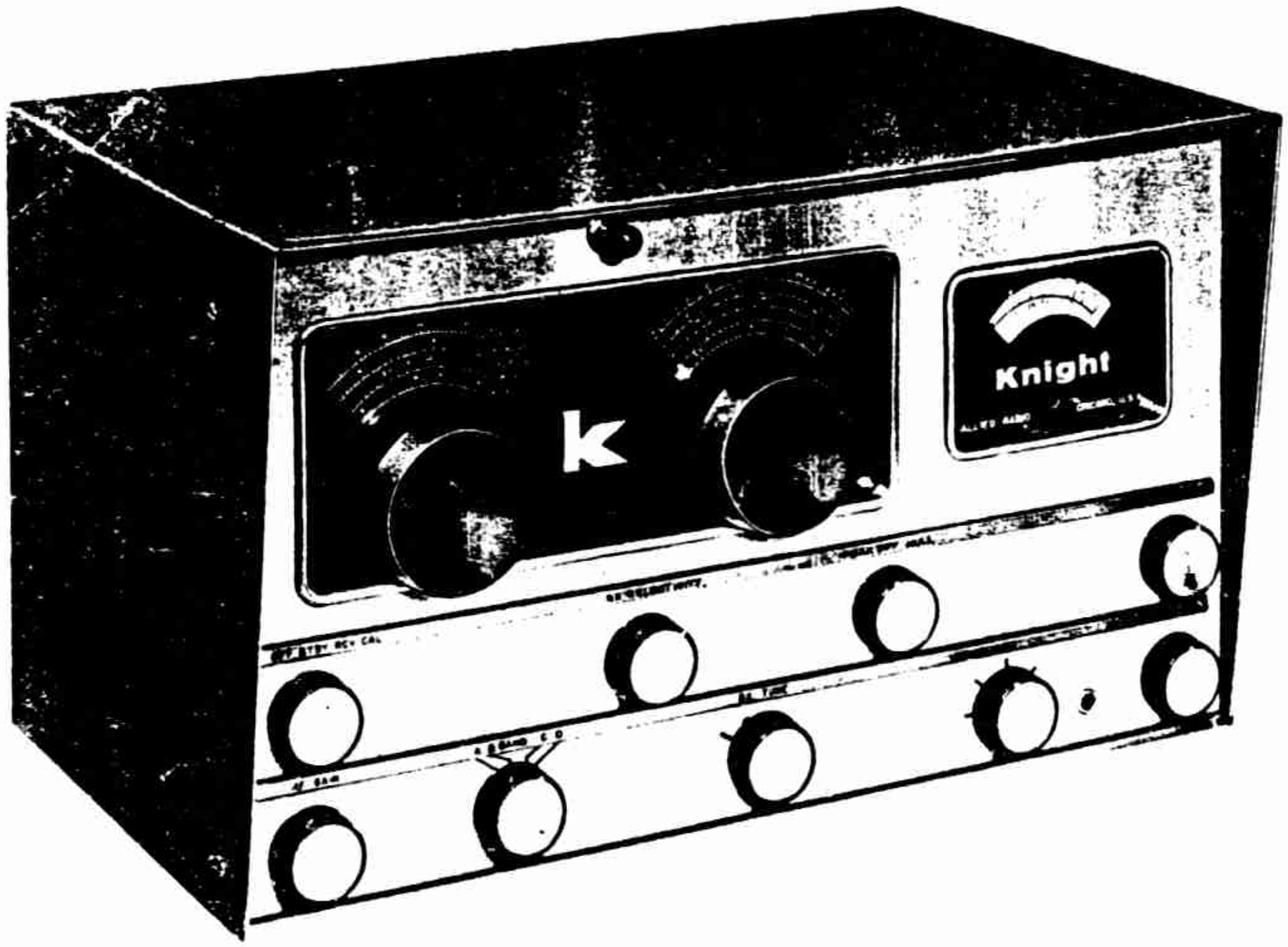
® REGISTERED TRADEMARK OF ALLIED RADIO CORP.—100 NORTH WESTERN AVENUE, CHICAGO 80, ILLINOIS — TELEPHONE HAYMARKET 1-680



MANUAL

R-100 AMATEUR COMMUNICATIONS RECEIVER

83 YU 726

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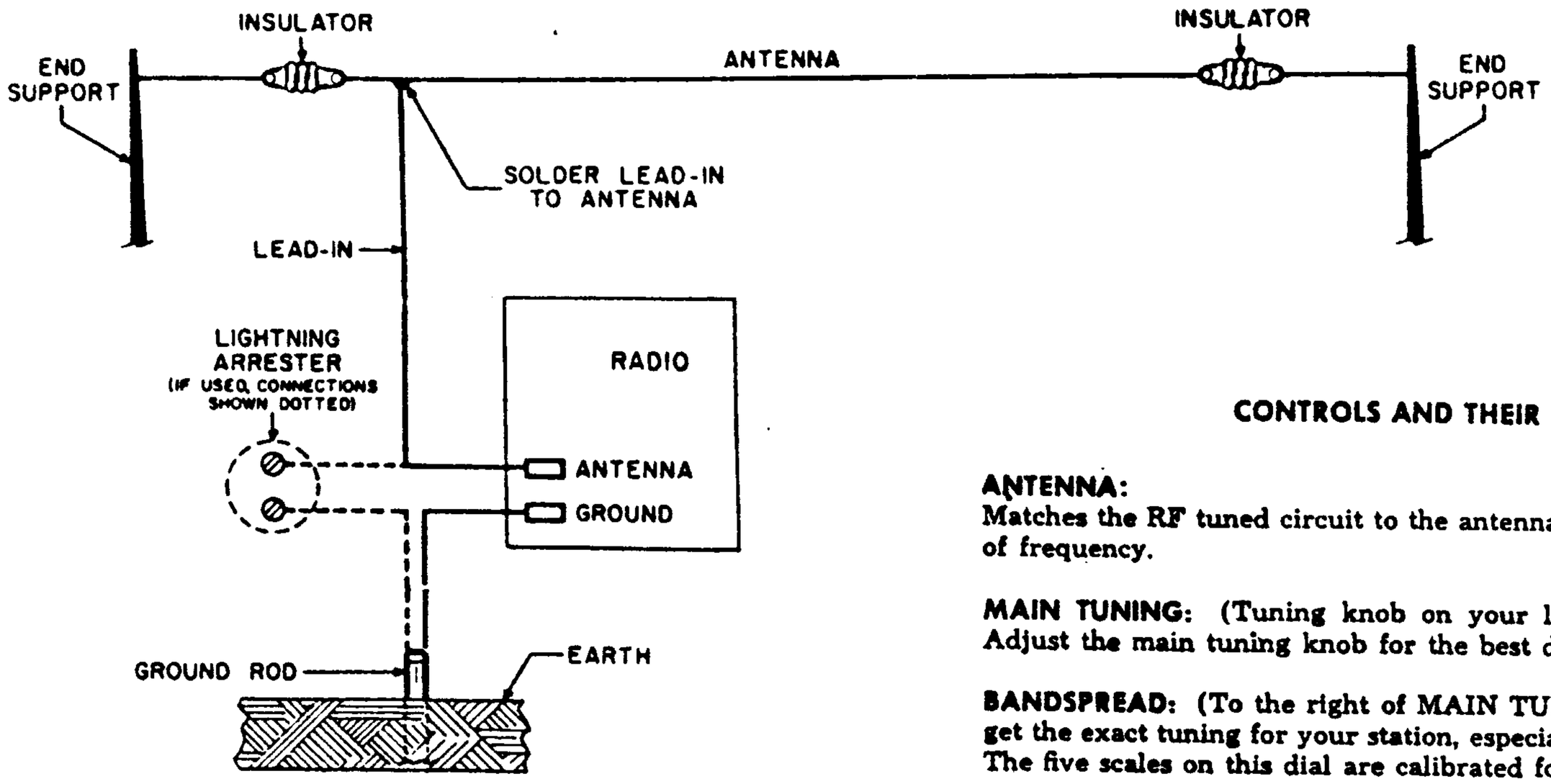


FIGURE 25. INSTALLING AN ANTENNA

OPERATING INSTRUCTIONS

You will gain the greatest pleasure from your receiver if you understand the full possibilities of this fine instrument. Those familiar with communications equipment will quickly recognize the added range and selectivity provided by this highly sensitive receiver. However, even the experienced operator will profit from a careful reading of the section on the use of the Q-Multiplier, since considerable skill and experience are required to fully realize the extra refinements afforded by these circuits.

For the new short wave listener, we suggest that these instructions be followed closely. The extra care used in tuning will be well rewarded by bringing in many distant (DX) stations. The section on the best time for shortwave listening will also be very helpful.

CONTROLS AND THEIR FUNCTIONS

ANTENNA:
Matches the RF tuned circuit to the antenna, when there is a major change of frequency.

MAIN TUNING: (Tuning knob on your left, as you face the receiver). Adjust the main tuning knob for the best dial setting for your station.

BANDSPREAD: (To the right of MAIN TUNING) For fine tuning. Use to get the exact tuning for your station, especially for weak or distant stations. The five scales on this dial are calibrated for Amateur bands 80-10 meters.

CAUTION: MUST BE TURNED FULLY CLOCKWISE WHEN USING THE MAIN TUNING DIAL. OTHERWISE MAIN DIAL CALIBRATIONS WILL BE INACCURATE.

OFF-STBY-RCV-CAL: Turns the receiver on and off. Always in the RCV (Receive) position for listening. Should always be turned to OFF when you are through using the receiver. STBY (Standby) position silences the receiver, but keeps the tubes warm, ready for instant use. CAL (Calibration) position is used only with an accessory crystal calibrator, to check dial calibrations.

QX SELECTIVITY: Sharpens the selectivity of the receiver. Use only as described in Q-Multiplier operating instructions.

PEAK-OFF-NULL: Switches the Q-Multiplier circuits to PEAK (accentuate) or NULL (cancel out). In OFF position QX SELECTIVITY and QX TUNE are switched out of the circuit.

BFO-MVC-AVC-ANL: Selects the mode of operation of the receiver. BFO position is for CW (code and single sideband reception) only. MVC, AVC and ANL are for voice or music listening. AVC (automatic volume control) is the normal position.

MVC (manual volume control) switches out the AVC circuit. Experienced operators will use this position when necessary. ANL (automatic noise limiter) is used only for unusually noisy conditions.

RF GAIN: Controls sensitivity by adjusting the gain (amplification) of the RF and first IF stage of the receiver.

A-B-BAND-C-D: Bandswitch selects the desired listening band. Covers:

BAND A	.54— 1.65	mc
BAND B	1.6 — 4.6	mc
BAND C	4.4 —12.4	mc
BAND D	12.0 —30.0	mc

QX TUNE: Use for tuning the Q-Multiplier circuits. See section on Q-Multiplier operation.

BFO: Adjusts the BFO frequency to produce the desired audio tone for code reception. It is also used for single sideband (SSB) reception.

AF GAIN: This is the volume control. Adjust for desired loudness.

S-METER: If you already have the S-Meter kit, you have a valuable tuning aid. Wherever the operating instructions describe tuning procedure, tune for maximum meter deflection. The S-Meter is calibrated to show accurate signal strength readings when the BFO-MVC-AVC-ANL switch is in the AVC position.

CONTROL SETTINGS FOR STANDARD BROADCAST RECEPTION

OFF-STBY-RCV-CAL	RCV
BFO-MVC-AVC-ANL	AVC
RF GAIN	Fully Clockwise
A-B-BAND-C-D	A
PEAK-OFF-NULL	OFF
MAIN TUNING	Turn dial to desired station. (Bandspread dial must be turned all the way to the right.)

BANDSPREAD: Not needed for local stations. Use for fine tuning for DX (distant) reception.

ANTENNA: Adjust for strongest signal.

AF GAIN: Adjust for desired volume.

CONTROL SETTINGS FOR SHORT WAVE LISTENING

Set controls same as for standard broadcasts above, except:

PHONE RECEPTION

A-B-BAND-C-D: Switch to B, C or D depending on frequency of station wanted.

MAIN TUNING: Turn dial to desired station. For Amateur phone reception, set the MAIN TUNING dial at the index mark for the desired Amateur band. Notice the index marks that are identified on Figure 26. The BANDSPREAD calibrations for the Amateur bands are accurate only when the MAIN TUNING dial is set to the mark for the band in use.

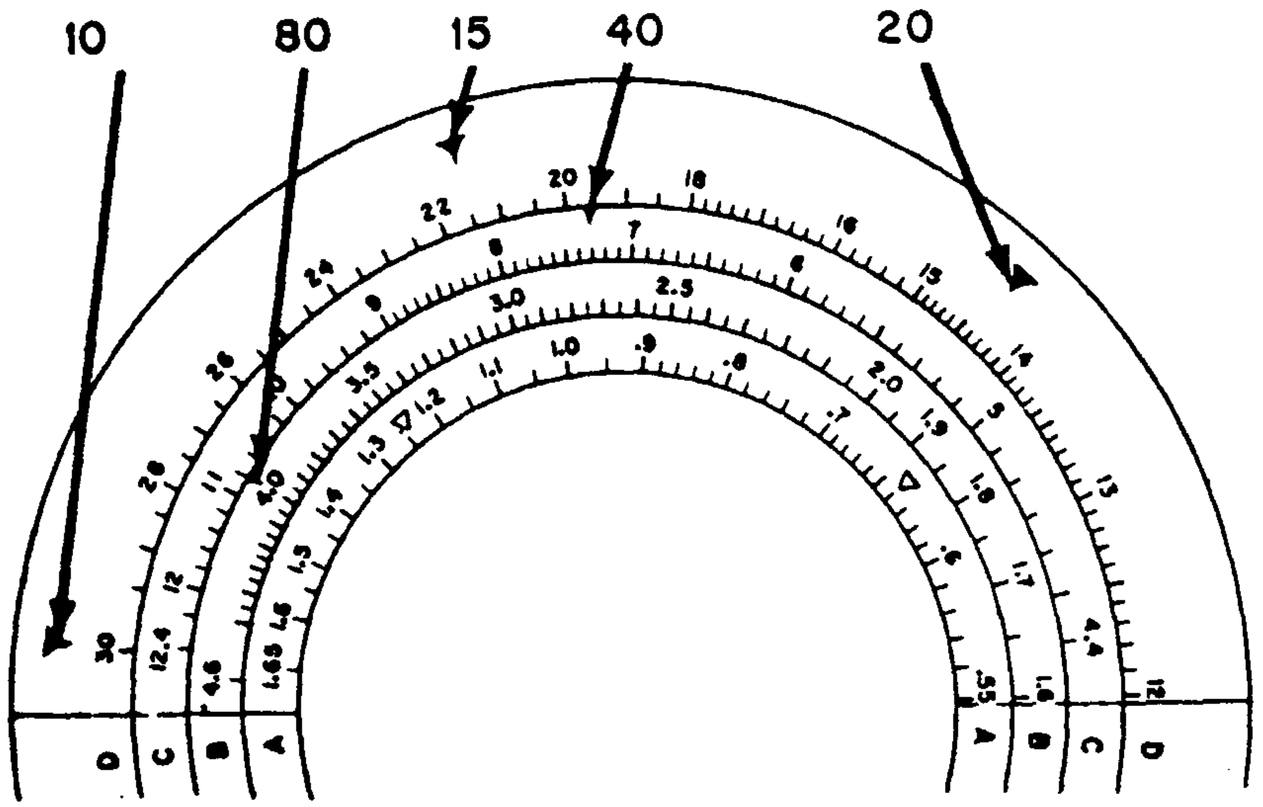


FIGURE 26. AMATEUR BAND INDEX MARKS (MAIN TUNING DIAL)

BANDSPREAD: After station is tuned in on MAIN TUNING dial, adjust BANDSPREAD knob for fine tuning. The BANDSPREAD control can be used in either of two ways. It can be left in a midway position while using the MAIN TUNING and then "rocked" a few degrees to the left or to the right for the best reception. Another method is to have it turned all the way to the right while the MAIN TUNING dial is set at the index mark for the desired Amateur band, or the high frequency end of any desired group of stations. Then the BANDSPREAD control can be slowly turned

to the left, sweeping through the group of stations until the desired station is heard clearly.

BFO-MVC-AVC-ANL: Usually in AVC position. May be switched to ANL during unusually noisy conditions, especially at the higher frequencies where automobile ignition and other man-made noises may interfere.

CW (CODE) RECEPTION

BFO-MVC-AVC-ANL	BFO
RF GAIN	Use as volume control
A-B-BAND-C-D	Set for desired band
AF GAIN	Set to maximum clockwise position

AMATEUR FREQUENCIES

BAND SETTING	AMATEUR BAND	FREQUENCY RANGE
B	80 meters	3.5 — 4.0 mc
C	40 meters	7.0 — 7.3 mc
D	20 meters	14.0 —14.35 mc
D	15 meters	21.0 —21.45 mc
D	10 meters	28.0 —29.7 mc

MAIN TUNING: Set the MAIN TUNING dial at the index mark for the desired Amateur band.

BANDSPREAD: Slowly turn the BANDSPREAD dial until the desired station is heard.

BFO: Adjust the BFO control for the most pleasing note.

SINGLE SIDEBAND RECEPTION

OFF-STBY-RCV-CAL: RCV

BFO-MVC-AVC-ANL: MVC

MAIN TUNING: To index mark for desired Amateur band.

BANDSPREAD: Precedence has established the use of SSB transmitters in certain sections of each Amateur band. At the present time, these are:

80 meter band	high frequency end
40 meter band	high & low freq. ends
20 meter band	high frequency end
15 meter band	high frequency end
10 meter band	around 28.65 mc

RF GAIN: AT MINIMUM

AF GAIN: AT MAXIMUM

A standard AM transmitted signal consists of an RF carrier and two sidebands, which results from the modulation of the RF carrier. A SSB signal is characterized by the suppression of the carrier and one of the side bands. Thus the transmitted signal consists of one sideband only. It is fast becoming an increasingly popular method of transmission because it occupies less space in the radio spectrum and because there is considerably less interference encountered among SSB signals during reception.

Reception of SSB signals requires the reinsertion of a carrier before the signal can be demodulated. This is done by the BFO.

Start by tuning to the portion of an Amateur band containing SSB signals. While tuning, turn the RF GAIN control up until loud, but unintelligible sounds are heard. It will sound something like duck quacking. Switch the BFO-MVC-AVC-ANL control to BFO and carefully tune the BFO control until intelligible sound is heard. The BFO control may be left at its setting while the BANDSPREAD dial is tuned to other stations. However, a change in sideband transmission from "lower" to "upper" sideband or vice-versa requires a readjustment of the BFO control.

THE Q-MULTIPLIER

The purpose of the Q-Multiplier and its associated controls (QX SELECTIVITY and QX TUNE) is to improve the selectivity of the receiver. Selectivity is the ability to select only the desired station, separating it from adjacent stations which may be very close in frequency. For domestic and foreign broadcasts, it is recommended that the Q-Multiplier (PEAK-OFF-NULL) be in the OFF position, to maintain full audio quality. However, the Q-Multiplier can be used if you are trying for DX reception and are not concerned with audio quality.

The Q-Multiplier can be used either to peak (accentuate) a narrow band of desired frequencies, or to null (cancel) a narrow band of undesired frequencies. Experience with these controls will soon teach you the best settings for the existing conditions.

HOW IT WORKS

An antenna input is provided for either open wire line or for coaxial cable.

The signal is fed from the antenna to the grid of the RF amplifier, V-1, the 6BZ6, through the tuned circuit of the last section (wafer E-F) of the band-switched coils and C-1A. The signal goes to the mixer (the pentode section of V-2, the 6BH8, through the tuned circuit of the band-switched (wafer C-D) coils and C-1B with the BANDSPREAD capacitor, C-2A. The first section of S-1 (wafer A-B) switches coils in the oscillator grid (the triode section of the 6BH8), which operates as a tuned grid oscillator. The oscillator is tuned by C-1C and by C-2B, the BANDSPREAD capacitor. This oscillator operates continuously even when the receiver is in standby position, and the plate of this tube is supplied with regulated voltage through V-3, the OB2. This insures maximum oscillator stability. The oscillator voltage injection takes place through a 10 $\mu\mu$fd capacitor on band A, through a 3.3 $\mu\mu$fd capacitor on band B, and through the internal capacity between the two sections of the 6BH8 on the two high bands, C and D.

The Q-Multiplier circuit is inserted at the output of the mixer. This is a tuneable null or peak circuit which either puts a sharp peak in the IF response curve, or a shiftable null which can be adjusted to provide as much as 60 db attenuation. This circuit makes it possible to tune out much of the unwanted interference and to bring in the wanted signal more clearly. This is accomplished with V-4 (the 12AX7), L-14, C-26, and the associated circuitry.

The IF amplifier section consists of the pentode sections of V-5 and V-6, both 6AZ8 tubes. These IF amplifiers are stabilized.

The detection takes place in the first of three diodes of the 6BC7, V-7. The second diode is used as a delayed AVC rectifier which can be turned off by S-3 at the front panel. A two-volt signal must be applied from the second detector before AVC action begins. The third section of the 6BC7 is used as a series noise limiter which cuts off the high noise peaks. This circuit is inserted between the second detector and the volume control by the switch, S-3, on the front panel.

The audio voltage amplifier consists of the triode section of the 6AZ8 second IF amplifier, V-6B. The output power amplifier, the pentode section of the 6AW8A (V-8), can either drive low impedance phones or an 8Ω speaker. The triode section of the 6AW8A is used as the beat frequency oscillator (BFO). The BFO output is injected into the grid of the second IF amplifier, V-6A, through the capacity coupling available in R-32, a 10megΩ resistor. Injecting the BFO output into the second IF reduces the power necessary to get adequate BFO action, which permits this circuit to operate with a minimum of harmonics.

The 6X4 full-wave rectifier tube, V-9, provides the DC operating voltages.

When this receiver is on "STANDBY", the cathodes of the RF amplifier and the first IF amplifier are biased to cut-off. "Break-in" operation is made possible by connecting an external keying relay to the "remote" terminals at the rear of the receiver when it is switched to "Standby". Shorting these terminals restores the receiver to operation.

This receiver is designed so the 100 kc Crystal Calibrator may be installed internally and operated from the front panel, as shown elsewhere in this manual.

The S-METER may be installed on the front panel and wired into the circuit as shown elsewhere in this manual.

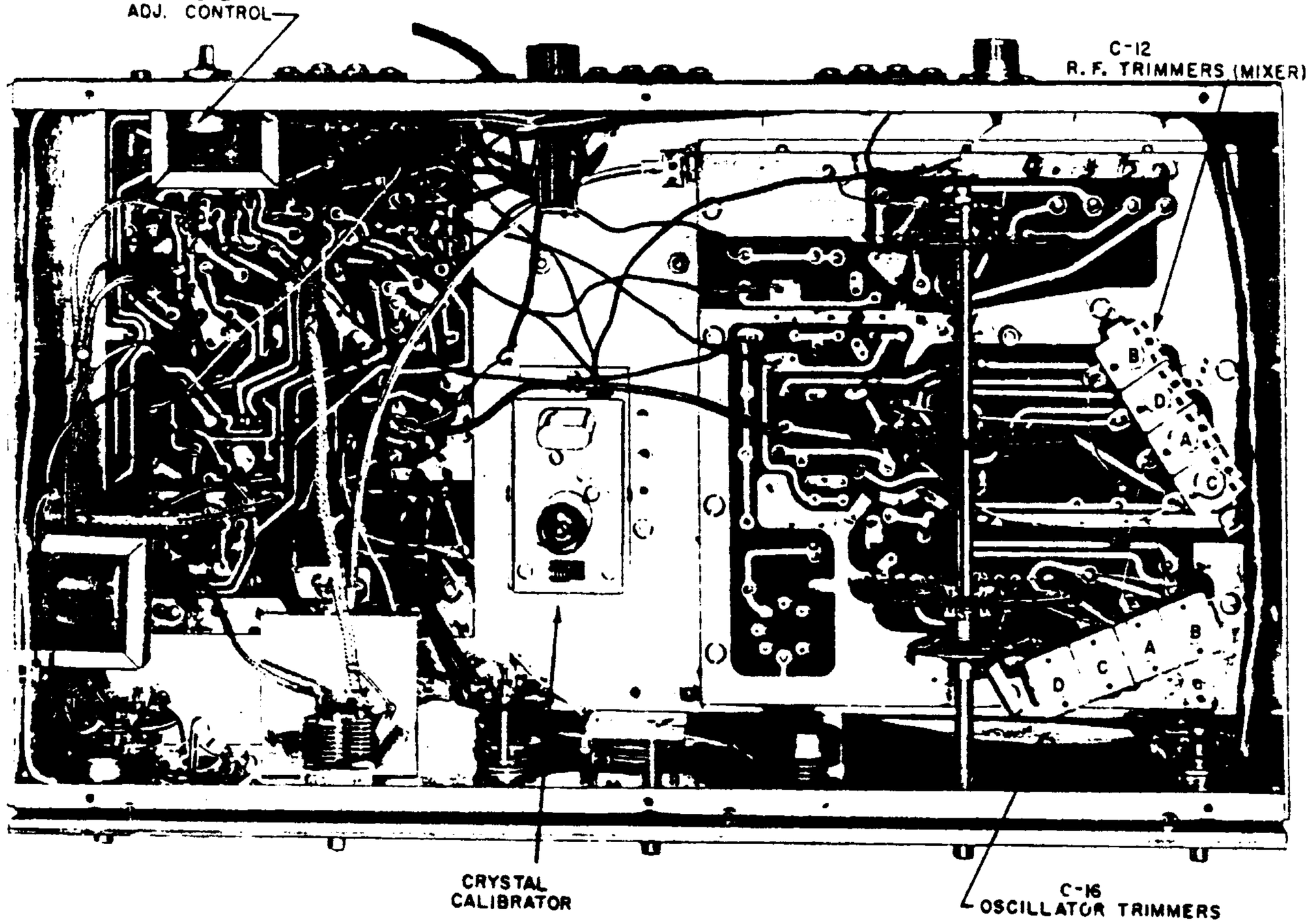
RESISTANCE CHART

Control positions: OFF-STBY-RCV-CAL in OFF; QX SELECTIVITY at maximum; PEAK-OFF-NULL in PEAK; BFO-MVC-AVC-ANL in AVC; RF GAIN at maximum; A-B-BAND-C-D in A; AF GAIN at maximum.

All readings from point indicated to chassis ground except: *Readings from point indicated to B+ (holes 11 and 12 on the IF printed circuit board.)

TUBE	PIN								
	1	2	3	4	5	6	7	8	9
V-1 6BZ6	3M	100K*	0	.1Ω	2.3K*	56K*	0	NS	NS
V-2 6BH8	0	27K	15K*	0	.1Ω	150Ω	82K	10K	2.7K
V-3 OB2	NS	0	4.5K*	NS	NS	NS	NS	NS	NS
V-4 12AX7	240K*	2.7M	1.5K	0	0	28K*	2.7M	5.6K	.1Ω
V-5 6AZ8	2.7K*	47K*	100K*	.1Ω	0	2.1M	0	0	0
V-6 6AZ8	2.7K*	47K*	680Ω	.1Ω	0	2M	2.7K	220K*	1M
V-7 6BC7	100Ω	1M	NS	0	1.2Ω	230K	230K	440K	0
V-8 6AW8A	open	47K	260K	0	.1Ω	180Ω	500K	0*	175Ω*
V-9 6X4	185Ω	NS	. .1Ω	0	NS	185Ω	300Ω*	NS	NS

NS = not significant.



PARTS LIST

CAPACITORS

Symbol No.	Description	Part No.
C-1	Main tuning	282023
C-2	Bandspread	286058
C-3	Antenna control, 80 μμfd, variable	281016
C-4	Molded tubular, .1 μfd —200V	296029
C-5	Ceramic disc, .01 μfd	276015
C-6	Mica, 100 μμfd	296023
C-7	Ceramic disc, .01 μfd	276015
C-8	Ceramic disc, .01 μfd	276015
C-9	Ceramic disc, .01 μfd	276015
C-10	Mica, 200 μμfd, 3%	295001
C-11	Ceramic disc, .01 μfd	276015
C-12	3-30 μμfd compression trimmers, four on bracket	285002
C-13	Mica, 680 μμfd	296019
C-14	Mica, 2000 μμfd	296020
C-15	Mica, 5000 μμfd	296021
C-16	3-30 μμfd compression trimmers, four on bracket	285002
C-17	Ceramic disc, .0047 μfd	276477
C-18	Ceramic tubular, 3.3 μμfd	276039
C-19	Ceramic disc, 10 μμfd	276018
C-20	Ceramic disc, 560 μμfd	277569
C-21	Ceramic disc, .01 μfd	276015
C-22	Ceramic disc, .01 μfd	276015
C-23	Ceramic disc, .0015 μfd	276157
C-24	Ceramic disc, .01 μfd	276015
C-25	Ceramic disc, .01 μfd	276015
C-26	QX TUNE	286071
C-27	Ceramic disc, 470 μμfd	276478
C-28	Mica, 2700 μμfd	296017
C-29	Mica, 1000 μμfd	296002
C-30	Ceramic disc, .0015 μfd	276157
C-31	Molded tubular, .1 μfd —200V	296029
C-32	Ceramic disc, .01 μfd	276015
C-33	Ceramic disc, .01 μfd	276015
C-34	Electrolytic, tubular, stand-up type 8 μfd —150V	209000
C-35	Ceramic disc, .002 μfd	276026
C-36	Molded tubular, .1 μfd —200V	296029
C-37	Ceramic disc, .01 μfd	276015
C-38	Mica, 600 μμfd	296018
C-39	Mica, 2700 μμfd	296017
C-40	BFO control, 50 μμfd variable	281011
C-41	Ceramic disc, .0015 μfd	276157
C-42	Ceramic disc, .01 μfd	276015
C-43	Ceramic disc, .02 μfd	276025
C-44	Ceramic disc, 470 μμfd	276478
C-45	Ceramic disc, .01 μfd	276015
C-46	Ceramic disc, .0015 μfd	276157
C-47	Ceramic disc, .0047 μfd	276477
C-48	Ceramic disc, 330 μμfd	276338
C-49	Electrolytic tubular, 10 μfd—25V	201100
C-50	Ceramic disc, 330 μμfd	276338
C-51	Ceramic disc, .0047 μfd	276477
C-52	Ceramic disc, 470 μμfd	276478
C-53	Electrolytic tubular, stand-up type, 50 μfd	209002
C-54	Electrolytic, 20/20 μfd—250V	234302
C-55	Ceramic disc, .0047 μfd	276477
C-56	Ceramic disc, .0047 μfd	276477
C-57	Mica, 100 μμfd	296023

Symbol No.	Description	Part No.
C-58	Mica, 100 μμfd, odd shaped	296022
C-59	Ceramic disc, .01 μfd	276015
C-60	Ceramic disc, 25 μμfd	296015
C-61	Ceramic disc, .01 μfd	276015
C-62	Ceramic disc, .01 μfd	276015
C-63	Mica, 33 μμfd	296339
C-64	Tubular ceramic, 50 μμfd ± 2%	See L-8

COILS

L-1	Oscillator, Band A	122203
L-2	Oscillator, Band B	122204
L-3	Oscillator, Band C	122205
L-4	Oscillator, Band D	122206
L-5	RF, Band A	122207
L-6	RF, Band B	122208
L-7	RF, Band C	122209
L-8	RF, Band D, with C-64 capacitor	122210
L-9	Mixer, Band A	162005
L-10	Mixer, Band B	162006
L-11	Mixer, Band C	162007
L-12	Mixer, Band D	162008
L-13	RF choke, 5 millihenries	161001
L-14	Q-Multiplier	162010
L-15	BFO	162009
L-16	Filter choke, 5.5 henries	140003

CONNECTORS

J-1	Coaxial antenna jack	502222
J-2	Phone jack	502228

RESISTORS

All resistors ½w, 10%, unless specified otherwise

R-1	68Ω	301680
R-2	RF GAIN control, 5KΩ	390115
R-3	100KΩ, 1 watt	304104
R-4	33Ω	301330
R-5	27KΩ	301273
R-6	4700Ω, 2 watt	307472
R-7	10KΩ, 1 watt	304103
R-8	47KΩ	301473
R-9	68Ω	301680
R-10	6800Ω	301682
R-11	2200Ω	301222
R-12	33Ω	301330
R-13	82KΩ	301823
R-14	150Ω	301151
R-15	820KΩ	301824
R-16	220KΩ	301224
R-17	2.7 megΩ	301275
R-18	1500Ω	301152
R-19	2700Ω	301272
R-20	100KΩ	301104
R-21	5600Ω	301562
R-22	330Ω	301331
R-23	2.7 megΩ	301275
R-24	QX SELECTIVITY control, 10KΩ	392164
R-25	QX NULL control, 5KΩ	390133
R-26	47KΩ	301473
R-27	2700Ω	301272
R-28	100KΩ	301104
R-29	27KΩ	301273
R-30	680Ω	301681
R-31	47KΩ	301473
R-32	10 megΩ	301106
R-33	2700Ω	301272
R-34	1 megΩ	301105
R-35	1 megΩ	301105
R-36	47KΩ	301473
R-37	220KΩ	301224
R-38	39KΩ	301393
R-39	100KΩ	301104
R-40	220KΩ	301224
R-41	220KΩ	301224
R-42	1 megΩ	301105
R-43	1 megΩ	301105
R-44	AF GAIN control, 1 megΩ	390009
R-45	2700Ω	301272
R-46	470KΩ	301474
R-47	82Ω	301820
R-48	100Ω	301101
R-49	220KΩ	301224
R-50	3.3Ω	301339
R-51	33Ω	301330
R-52	1 megΩ	301105
R-53	10KΩ	301103
R-54	100KΩ	301104

SWITCHES

S-1	A-B-BAND-C-D	435004
S-2	PEAK-OFF-NULL	437066
S-3	BFO-MVC-AVC-ANL	432130
S-4	OFF-STBY-RCV-CAL	432131

TERMINAL STRIPS

TS-1	2-screw terminal	441201
TS-2	2-screw terminal	441201
TS-3	4-terminal	440401
TS-4	2-screw terminal	441201
TS-5	3-terminal	440301
TS-6	2-terminal	440202
TS-7	2-terminal	440201

BULBS

I-1	Dial Light #47	640002
I-2	Dial Light #47	640002

TRANSFORMERS

Z-1	Intermediate frequency	122211
Z-2	Intermediate frequency	122211
Z-3	Intermediate frequency	122211
T-1	Output	102200
T-2	Power	101311

FUSE

F-1	1 Ampere	491001

TUBES

V-1	6BZ6	610050
V-2	6BH8	611023
V-3	OB2	610051
V-4	12AX7 ECC83	611012
V-5	6AZ8	611024
V-6	6AZ8	611024
V-7	6BC7	611025
V-8	6AW8A	611026
V-9	6X4	610023

MISCELLANEOUS

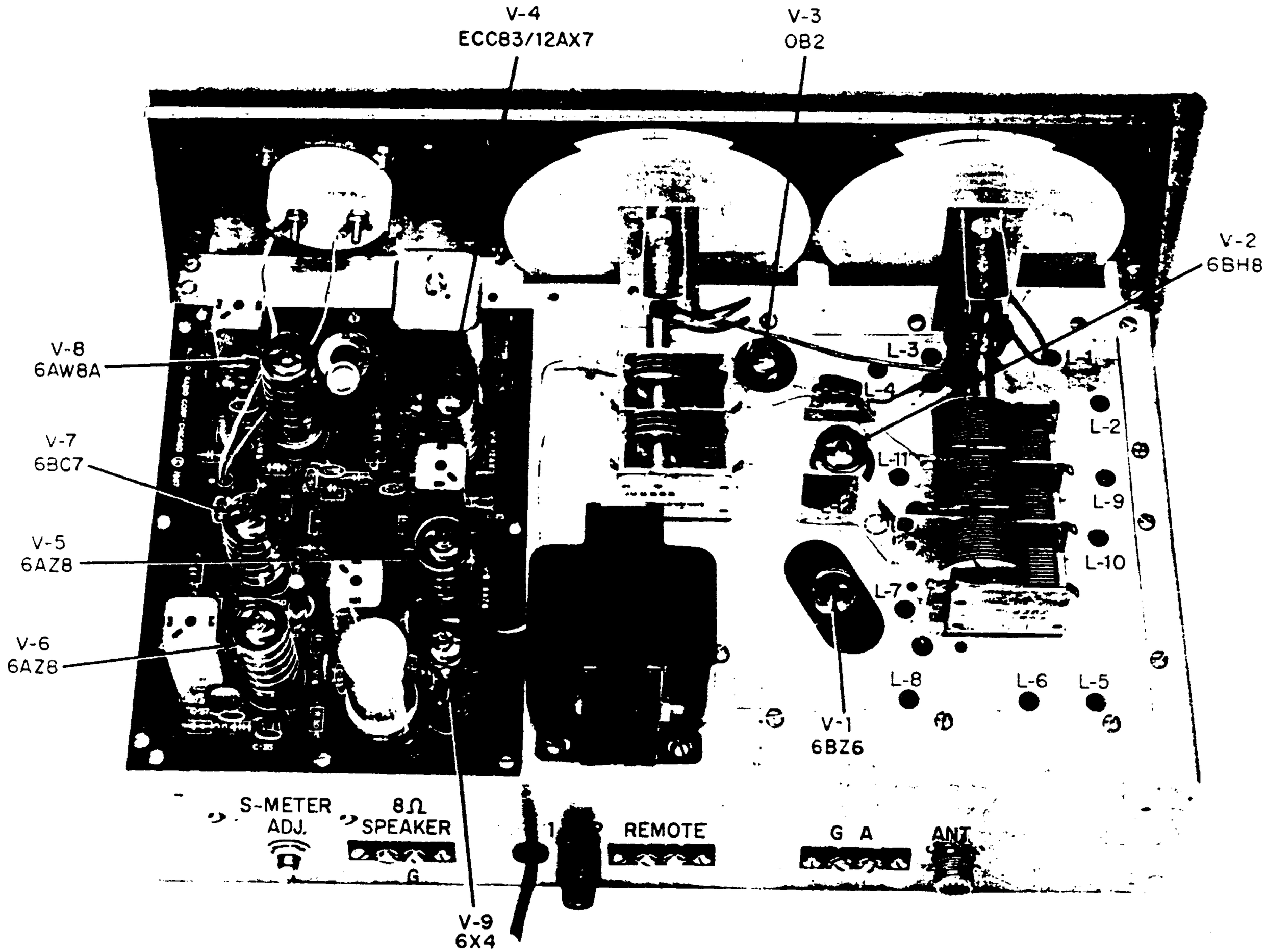
Description	Quantity	Part No.
Alignment tool, I.F.	1	957000
Alignment tool, R.F.	1	957003
Board, printed circuit, I.F.	1	820019
Board, printed circuit, R.F.	1	820020
Bushing, threaded, ⅜"	2	470075
Cabinet	1	702056
Collar, Threaded	2	470253
Chassis	1	463482
Dial, crystal	1	870063
Dial, bandspread tuning	1	870046
Dial, main tuning	1	870165
Drive bracket, vernier	2	470113
Felt pad	2	850152
Foot, rubber	4	831001
Front panel	1	463476
Front sub-panel	1	463490
Grommet, small	3	830001
Grommet, large	1	830004
Holder, fuse, with hardware	1	492200
Knob, control	10	765074
Knob, tuning and bandspread	2	765052
Pointer, QX TUNE	1	470569
S-Meter hole cover	1	870153
Shaft	2	470470
Shaft coupler	2	470114
Shaft, metal flexible	1	860012
Shield, BFO capacitor	1	470107
Shield bracket, RF chassis	1	470345
Shield, can, Q-multiplier	1	470121
Shield, tube, medium	1	510002
Shield, tube, short	4	510004
Shield, tube, long	2	510003
Socket, tube, 7-pin	2	501672
Socket, tube, with ground-clip, 7-pin	1	501674
Socket, tube, with ground-clip, 9-pin	6	501695
Socket, dial light	2	501194
Sub-chassis, R-F	1	463402
Vernier drive	1	470475

HARDWARE

Lockwasher, #4	15	582200
Lockwasher, #6	54	582300
Lockwasher, ⅜"	8	582700
Lockwasher, ½"	2	582800
Nut, 3-48	12	570110
Nut, 4-40	14	570220
Nut, 6-32	35	570340
Nut, ⅜-32	14	570840
Nut, ½-20	2	570960
Screw, 3-48x3/8", flat-head	12	563114
Screw, 4-40x3/8"	14	560224
Screw, 6-32x1/4"	8	560342
Screw, 6-32x5/16"	48	560343
Screw, 6-32x5/16", flat-head	2	563343
Screw, 6-32x7/16"	2	560345
Screw, self-tapping	4	562393
Setscrew, 6-32x1/4"	2	563342
Setscrew, 8-32 1/4", headless	4	569001
Solder lug, #6	4	553005
Solder lug, ⅜"	1	553001
Spade lug, 6-32	3	568344
Washer, flat, #6 hole	8	580300
Washer, flat, 25/64"	7	580702
Washer, C	4	585002

WIRE, SOLDER, AND SPAGHETTI

Braid shielding 2½"	1	804005
Cable, 9-conductor, 30"	1	808009
Cord, Line	1	802001
Solder, 20 ft.	1	931020
Spaghetti, #20, 15"	1	812001
Wire, 2", red	2	807022
Wire, 3", orange	4	807023
Wire, 4", yellow	9	807024
Wire, 5", green	3	807025
Wire, 6", blue	2	807026
Wire, 7", violet	3	807027
Wire, 12", white/red	1	807032
Wire, 16", white/blue	1	807035
Wire, red stranded, #22, 9"	1	807002
Wire, shielded, insulated 16"	1	808010
Wire, shielded, 41"	1	808003
Wire, bare, #20, 38"	1	806600



EQUIPMENT USED FOR SPECIFICATION MEASUREMENTS

Simpson Model 390 Wattmeter	Hewlett-Packard Model 400D AC VTVM
Simpson Model 260 VOM	Tektronix Model 531 Oscilloscope
Triplett Model 630A VOM	Measurements Corp. Model 65B RF Generator
Frequency Standard BC 221	

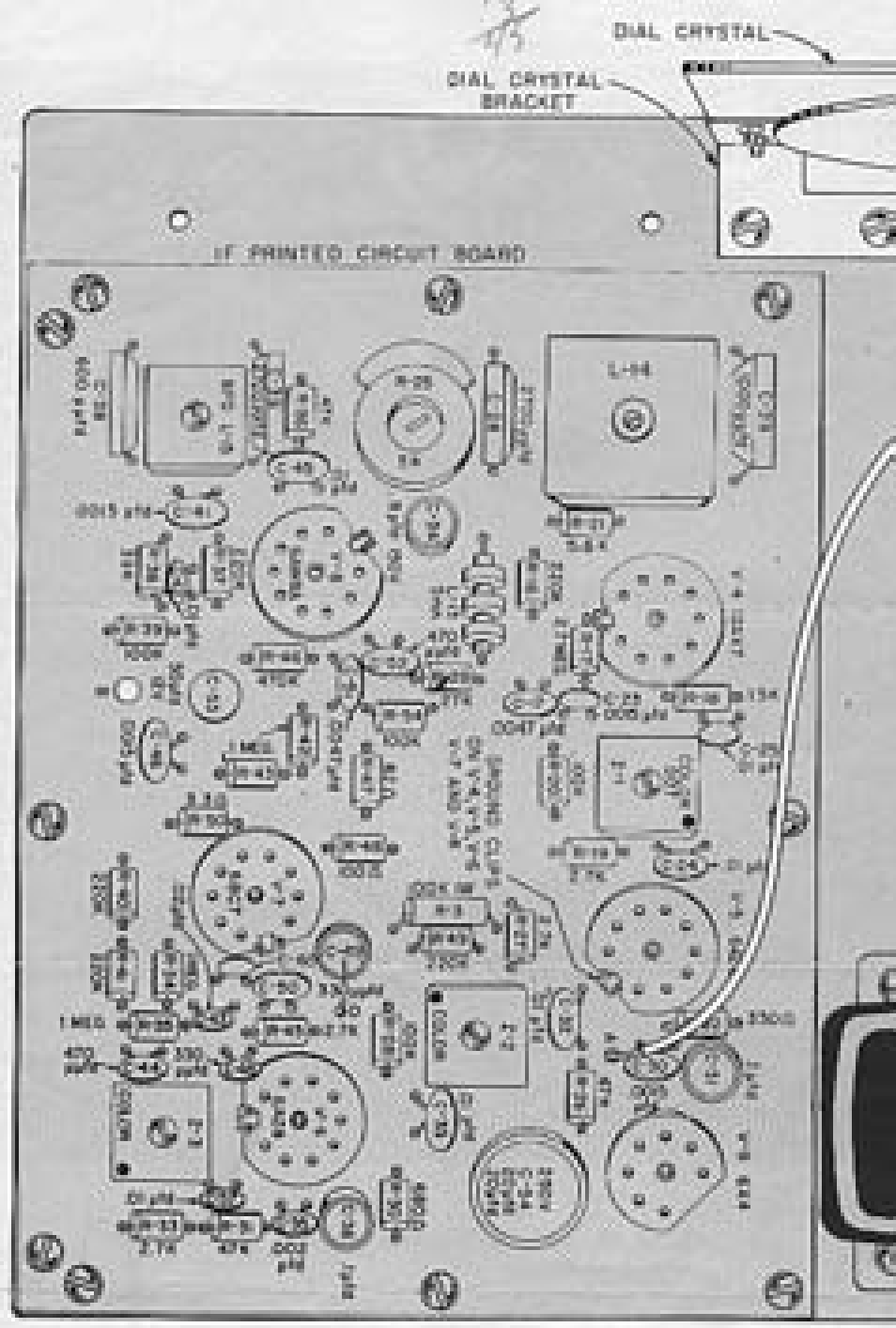


FIGURE 20. PAR

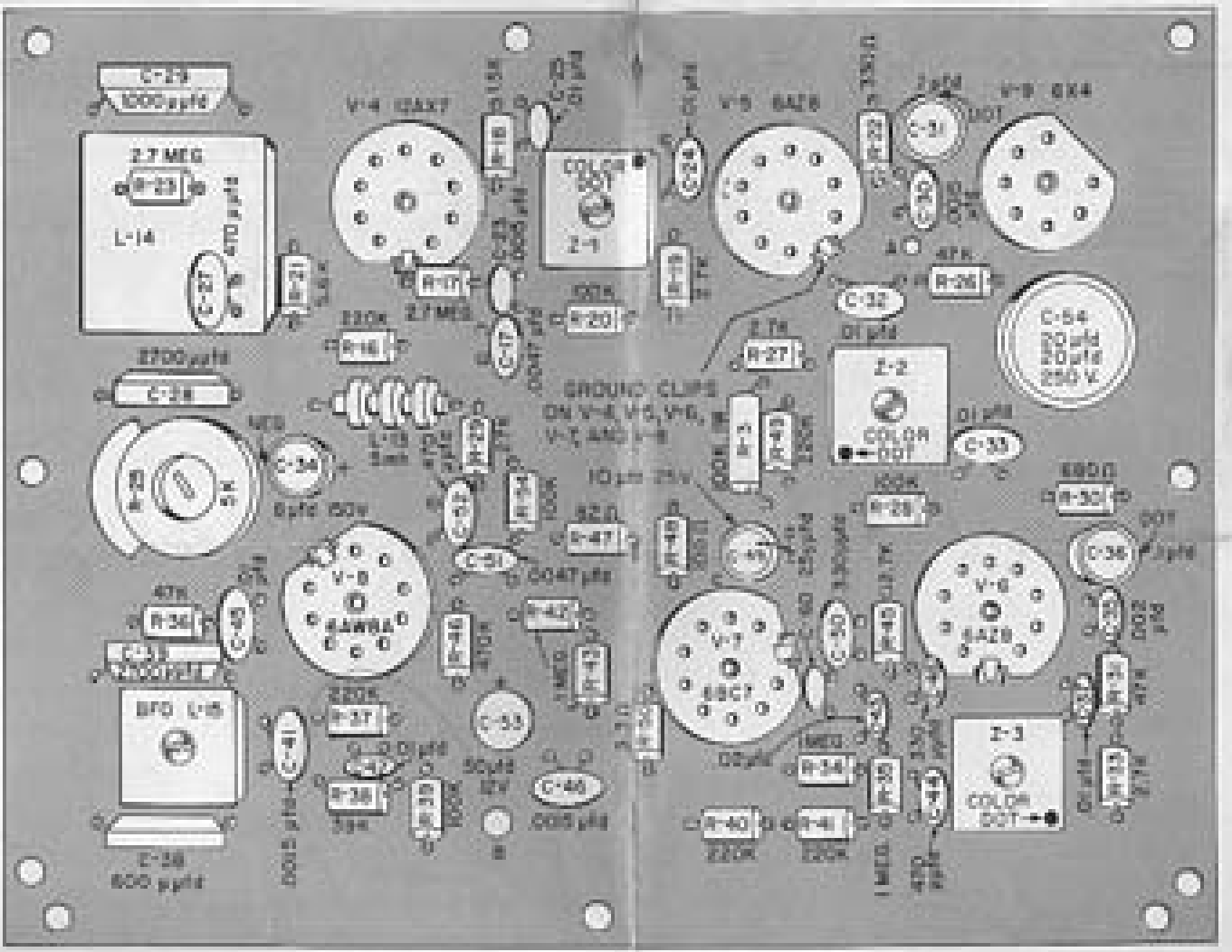
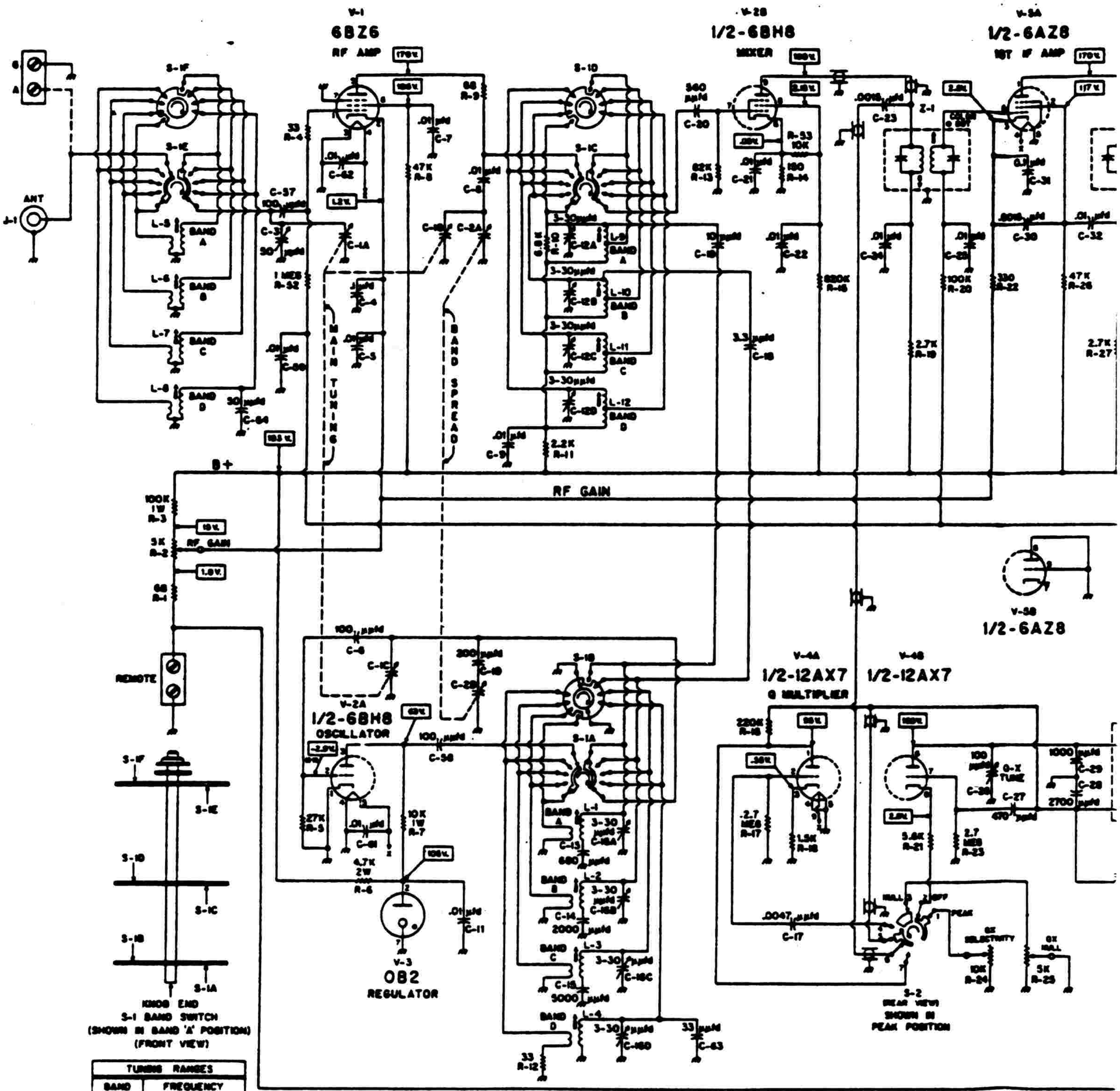


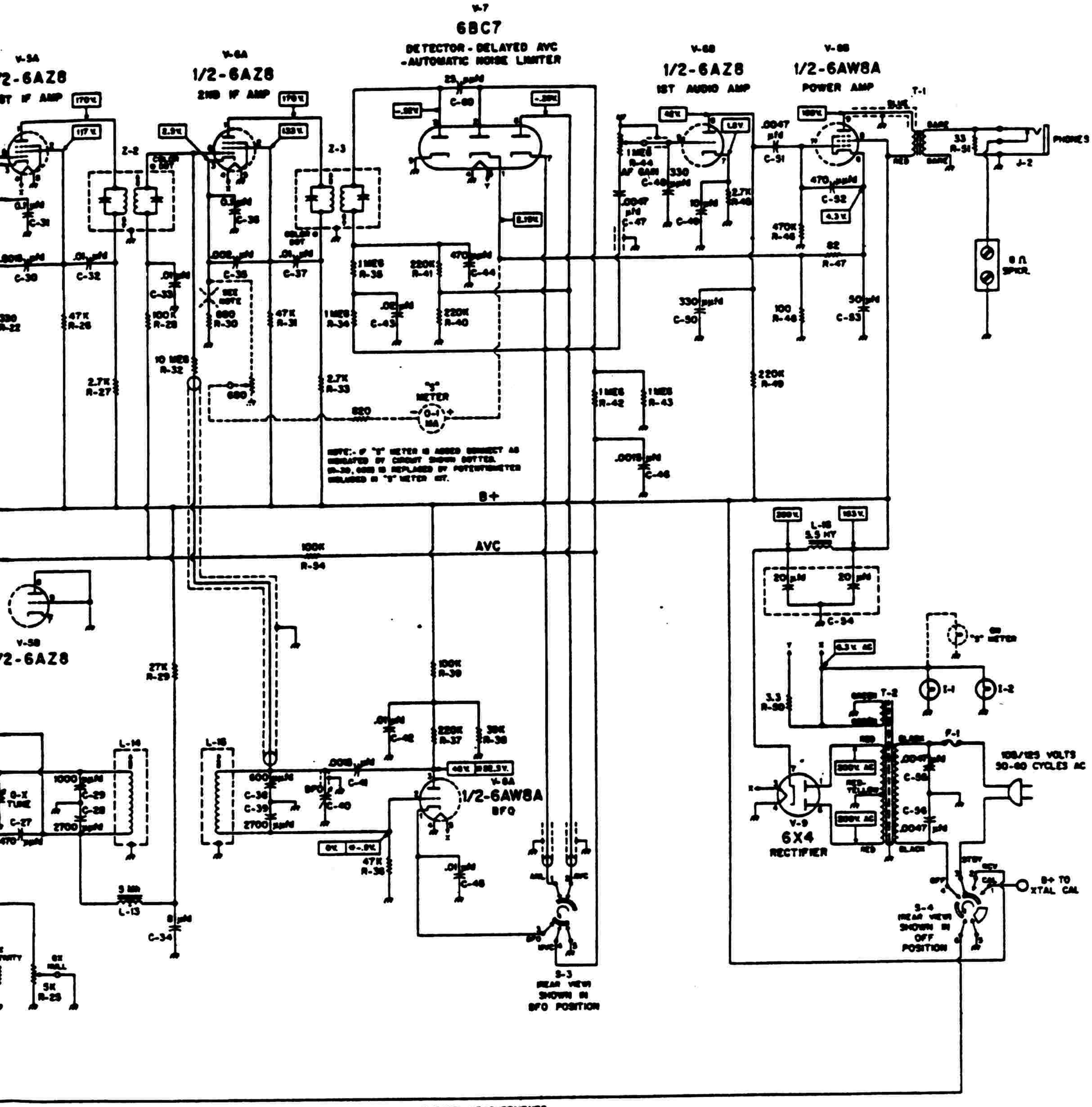
FIGURE 1. PARTS MOUNTING ON THE IF PRINTED CIRCUIT BOARD



TUNING RANGES	
BAND	FREQUENCY
A	.54 - 1.68 MC
B	1.8 - 4.6 MC
C	4.4 - 12.4 MC
D	12 - 30 MC

NOTES

RESISTORS INDICATED IN OHMS
K = 1,000 OHMS
MEG = 1,000,000 OHMS



VOLTAGE MEASUREMENTS

ALL VOLTAGE MEASUREMENTS ARE TAKEN FROM POINTS INDICATED TO GROUND WITH A VTVM. NO SIGNAL INPUT.

BAND SWITCH S-1 ON BAND 'A' POSITION.

S-2 IN OFF POSITION.

RF GAIN SET AT MAXIMUM.
AF GAIN SET AT MINIMUM.
S-3 IN MVC POSITION.

* VOLTAGES WITH S-3 IN BFO POSITION.

* * VARIES WITH SETTING OF C-1